Simple Models of SL-9 Impact Plumes

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The impacts of the larger fragments of Comet Shomaker-Levy 9 on Jupiter left debris patterns of consistent appearance, likely caused by the landing of the observed impact plumes. Realistic fluid simulations of impact plume evolution may take months to years for even single computer runs. To provide guidance for these models and to elucidate the most basic aspects of the plumes, debris patterns, and their ultimate effect on the atmosphere, we have developed simple models that reproduce many of the key features. These Monte-Carlo models divide the plume into discrete mass elements, assign to them a velocity distribution based on numerical impact models, and follow their ballistic trajectories until they hit the planet. If particles go no higher than the observed ∼3,000 km plume heights, they cannot reach the observed crescent pattern located ∼10,000 km from the impact sites unless they slide horizontally after ballistic flight. By introducing parameterized sliding or higher trajectories, we can reproduce most of the observed impact features, including the central streak, the crescent, and the ephemeral ring located ∼30,000 km from the impact sites. We also keep track of the amounts of energy and momentum delivered to the atmosphere as a function of time and location, for use in atmospheric models (D. Deming and J. Harrington, this meeting).

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